

FORM PTO-1390 (Modified)
(REV 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

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U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

10/088908INTERNATIONAL APPLICATION NO.
PCT/JP00/05289INTERNATIONAL FILING DATE
7 August 2000PRIORITY DATE CLAIMED
None

TITLE OF INVENTION

METHOD FOR FABRICATING A FLAT, LIGHT-EMITTING DISPLAY PANEL

APPLICANT(S) FOR DO/EO/US

Hisatoshi KISHI et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Notice of Priority/ Form PTO-1449**Drawings (5 sheets)/Cited References (2)****Cited Pending Applications (2)/List of Related Cases**

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 10/088908		INTERNATIONAL APPLICATION NO. PCT/JP00/05289		ATTORNEY'S DOCKET NUMBER 220012US2PCT	
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24. The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1040.00 <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	8 - 20 =	0	x \$18.00	\$0.00	
Independent claims	2 - 3 =	0	x \$84.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$890.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				\$0.00	
SUBTOTAL =				\$890.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL FEES ENCLOSED =				\$890.00	
				Amount to be: refunded	\$
				charged	\$

- a. ☒ A check in the amount of **\$890.00** to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **15-0030** A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Surinder Sachar
Registration No. 34,423



22850

SIGNATURE

Marvin J. Spivak

NAME

24,913

REGISTRATION NUMBER

March 25 2002
DATE

5/pvts

SPECIFICATION

METHOD FOR FABRICATING
A FLAT, LIGHT-EMITTING DISPLAY PANEL

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TECHNICAL FIELD

The invention relates to a method for fabricating a flat, light-emitting display panel having electrodes extended from a rear panel and sealing the margin of panels with a fritted glass.

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BACKGROUND ART

A large-screen monitor grows in demand as an information-oriented society moves forward in recent years. Generally, it is difficult in view of technical reason or cost-reduction measure that the large-screen monitor is comprised of only one display device (hereafter, referred as a panel). Therefore, plural panels are tiled to constitute the conventional large-screen monitor.

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In the case, when no-displayed area arranged at ends of each panel is large, seams defined between the adjacent panels become prominent. As a result, imagery quality of the whole of the large-screen is reduced. Therefore, it is desirable that a flat, light-emitting display panel, which has small, no-displayed area at each panel and displays a high quality of image on the large-screen, is developed.

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The applicants previously propose a structure of the flat, light-emitting display panel formed from a matrix of the plural panels to fit such a need.

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FIG. 1 is a cross sectional view of a side-seal structure of the flat, light-emitting display panel (hereafter, referred as a display panel) disclosed in the previous, co-pending application. In the drawing, a reference numeral 1 denotes a transparent, front panel. A reference numeral 2 denotes a rear panel, which is arranged in parallel to the front panel 1 and having a plurality of recesses 2a. Each recess 2a is defined as a discharging space for a display cell. An electrical insulating glass layer (not shown) is formed at a bottom face and an inner wall of each recess 2a of the rear panel 2. A fluorescent substance 3 is applied on the electrical insulating glass layer. A pin electrode (not shown) penetrating the rear panel 2 is arranged within the front panel 1. A pair of cell-type electrodes

(not shown) are arranged at every area of the front panel 1 facing each of the recesses 2a of the rear panel 2.

With such a constructed display panel, in order to reduce the no-displayed area in ends of display panel, the pin electrode (not shown) connecting with the electrode arranged at the front panel 1 is extended from the rear panel. The size of the front panel 1 is set to a value larger than that of the rear panel 2. A frit seal 4 is applied to an extended area 1a of the front panel 1 that extends off the rear panel 2 and to a side face 2b of the rear panel 2 and burned the whole of components. As a result, the margin of the front panel 1 and the rear panel 2 is sealed.

Next, a method for fabricating a display panel will be explained in order of undergoing process.

(Step 1)

A transparent electrode (not shown) including a discharging gap is formed at the front panel 1 using an ITO (indium-tinned oxide) or a Nesa (tinned oxide), for example.

(Step 2)

Electric terminals are formed at one end of the transparent electrode (not shown) formed in the previous step 1 by a screen printing method using conductive materials such as an Ag or silver and so on.

(Step 3)

Electrical insulating glass layers (not shown) are formed at the whole of the front panel 1 except for the electric terminals (not shown) formed in the step 2.

(Step 4)

Pin electrodes (not shown) are projected in the electric terminals (not shown), respectively.

(Step 5)

A MgO film is formed on the electrical insulating glass layer (not shown) formed in the previous step 3 to finish all processes regarding the front panel 1.

(Step 6)

Recesses 2a, which are defined as a through-hole for passing through the pin electrode (not shown) and functioned as a discharging space for a display cell, are formed at the rear panel 2 using a sandblasting method and so on.

(Step 7)

Fluorescent substance (R: red, G: green, B: blue) 3 is applied to

the bottom face and the inner wall of the recess 2a formed in the previous step 6 using the screen printing method and so on to finish all processes regarding the rear panel 2.

(Step 8)

5 Each of the pin electrodes (not shown) projected at the front panel 1 is fitted into each of the through-hole (not shown) of the rear panel 2. The rear panel 2 is stacked to the front panel 1 so that the fluorescent substance 3 faces the front panel 1.

(Step 9)

10 Ends of the front panel 1 and those of the rear panel 2 having no pin electrodes are stacked and fixed using a spring-loaded clip (not shown).

(Step 10)

A frit seal is applied to the pin electrode (not shown) using a dispenser (not shown).

15 (Step 11)

After the frit seal 4 applied in the previous step 10 is dried, the spring-quipped clip (not shown) is removed. The frit seal 4 is applied to a pipe-shaped, tipped section (not shown) and an outer periphery of the panel, that is, the extended area 1a of the front panel 1 and the side face 2b of the rear panel 2 using the dispenser (not shown).

20 (Step 12)

Weights (not shown) is placed at a part other than the pipe-shaped, tipped section (not shown) and the pin electrode (not shown) and the frit seal 4 is then burned. Air is exhausted from a space between the panels and discharge gas is filled and sealed in the space.

25 (Step 13)

The MgO adhered to the pin electrode (not shown) is removed using a sandblasting method and so on. In this way, a display panel is obtained.

30 When plural display panels, which are fabricated by the processes as described above and disclosed in the previous application, are arranged, lighted and displayed, there may be case where a display gap is formed between adjacent panels.

35 The present inventors investigated adequately the cause of gap in the display panel and found that a frit seal, which is formed at the extended area 1a of the front panel 1 and the side face 2b of the rear panel 2, is spread into the display cell. Namely, when the fluorescent substance 3 applied to the rear panel 2 or an area of the front panel 1 corresponding to the fluorescent substance 3 is covered with the frit seal spread into

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the display cell, light is not emitted or cut off from the covered section. Therefore, it results in no-emitting area or no-displayed area being increased at the ends of the display panel. The no-emitting area is considered to seem like a gap between adjacent panels.

5 A gap between the front and rear panels 1 and 2 when the frit seal 4 is applied to the extended area 1a of the front panel 1 and the side face 2b of the rear panel 2 is considered to become a cause of spread of the frit seal. In the step 11, the spring-loaded clip (not shown) is removed and a distance of a gap between the front panel 1 and the rear panel 2 is measured using a gap-measurement gage (not shown) before the gap is sealed with the frit seal. As a result, a gap of approximately 0.15mm was found. When a large-sized gap is formed at the gap, the frit seal 4 is applied thereto to result in the frit seal 4 in a large amount being inserted into the gap. The frit seal 4 is burned in the step 12 to result in a softened frit seal 4 in a large amount being inserted into the cell.

Such a gap is formed due to warping occurred in the front panel 1 and the rear panel 2. The electrical insulating glass layer (not shown) in approximately 30 um thickness is formed at a surface of the front panel 1. The recess 2a is formed at a surface of the rear panel 2. Therefore, there has a tendency to warp any panels so as to deform their surfaces (opposite surfaces) to be convex. In the state, when the ends of the both panels are cramped using the spring-loaded clip 5 as shown in FIG. 5 (Step 5), both central sections of the panels 1 and 2 is distanced from each other. Therefore, the pin electrode located at the central section must be provisionally fixed using the frit seal (Step 10). Moreover, the recess 2a of the rear panel 2 and the pin electrode are not illustrated and are omitted in FIG. 2 and FIG. 3. Next, in order to apply the frit seal 4 to the extended area 1a of the front panel 1 and the side face 2b of the rear panel 2, the spring-loaded clip 5 is removed. At this time, since the both panels intend to return to their original state, the gap is formed between the ends of the both panels as shown in FIG. 2.

Furthermore, the following other factors are considered to become a cause of the spread of the frit seal. That is, the frit seal 4 is softened at the side of the front panel 1 and the rear panel 2 on burning to pass through a micro-gap between the front and rear panels 1 and 2 by capillary action toward the cell. In order to decrease the spread of the frit seal, the flowability of the frit seal 4 must be set to become a small value on

softening. Therefore, we have learned that the frit seal 4 must be burned on condition that the burning is performed at a low temperature or for a short time.

5 However, when the frit seal 4 is burned on such a condition, reduction of the spread of the frit seal 4 into the cell can occur. When a voltage is applied to the display panel, there are malfunctions that discharge occurs abnormally at the pin electrodes. There is a reason: when the frit seal 4 is burned on the condition above, the frit seal 4 having a low flowability
10 can not flow adequately into the pin electrode. The pin electrode is coated inadequately with the frit seal 4 and the insulating properties are reduced. As a result, the discharge occurs abnormally when the voltage is applied to the display panel.

15 On the other hand, in order to coat perfectly the pin electrode, it is necessary to burn the frit seal 4 at a high temperature or for a long time. In such a case, there is a malfunction that the softened frit seal 4 applied to the ends of the panel is spread into the cell. That is, the coating of the pin electrode and the spreading of the frit seal applied
20 to the ends of the panel are mutually contradictory and it is difficult to maintain compatibility between both sides.

 The invention was made to solve the foregoing problems. Accordingly, it is an object of the invention to provide a method for fabricating a flat,
25 light-emitting display panel that a pin electrode can be coated perfectly with a frit seal and that reduction of the spread of the frit seal into a cell can occur.

DISCLOSURE OF THE INVENTION

30 In order to achieve the object of the invention, we provide a method for fabricating a flat, light-emitting display panel including a transparent, front panel, a rear panel arranged in parallel to the front panel and having a plurality of recesses, each recess being defined as a discharging space for a display cell, a pin electrode projected inwardly in a state of
35 penetrating the rear panel, and a pair of cell-type electrodes, which works at the presence of voltage from the pin electrodes, arranged at every area of the front panel facing each of the recesses of the rear panel, wherein the method comprises the steps of: applying frit seal to the pin electrodes in a state of pressing the rear panel against the front panel to keep them
40 in contact with one another using a flat plate having an opening formed

at a position corresponding to each of the pin electrodes; drying the frit seal to fix provisionally the rear panel to the front panel; detaching the flat plate from the both panels; applying frit seal to an end of the front panel and a side face of the rear panel; and burning the whole of components. In this way, both of the panels are fixed provisionally on condition that the panels are kept uniformly in contact with one another using the flat plate. In this way, it is possible to prevent a gap formed between both of the panels due to their warping and to prevent the frit seal from spreading into the gap between both of the panels. Moreover, it is unnecessary to vary conditions for burning the frit seal. The frit seal is therefore burned on condition that the pin electrodes 6 can be coated adequately.

With the above arrangement, the method may comprise the steps of: placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and securing the flat plate to the base plate by screws. In this way, the front panel and the rear panel are sandwiched between the flat plate and the base plate to keep the both panels in contact with one another. It is therefore possible to reliably prevent the spread of the frit seal into the gap between the both panels on application of the frit seal and on burning.

With the above arrangement, the method may comprise the steps of: placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and securing the flat plate to the base plate by screws through a plurality of biasing means. In this way, the front panel and the rear panel are sandwiched between the flat plate and the base plate to keep the both panels in contact with one another. It is therefore possible to reliably prevent the spread of the frit seal into the gap between the both panels on application of the frit seal and on burning.

With the above arrangement, the frit seal, which is applied to the end of the front panel and the side face of the rear panel, may have flowability less than the frit seal applied to the pin electrodes. In this way, it is possible to reduce the amount of the frit seal, which spreads from the margins of the both panels into the gap, to the minimum level.

We provide a method for fabricating a flat, light-emitting display panel including a transparent, front panel, a rear panel arranged in parallel to the front panel and having a plurality of recesses, each recess being

defined as a discharging space for a display cell, a pin electrode projected inwardly in a state of penetrating the rear panel, and a pair of cell-type electrodes, which works at the presence of voltage from the pin electrodes, arranged at every area of the front panel facing each of the recesses of the rear panel, wherein the method comprises the steps of: applying frit seal to an end of the front panel and a side face of the rear panel in a state of pressing the rear panel against the front panel to keep them in contact with one another using a flat plate having an opening formed at a position corresponding to each of the pin electrodes; drying the frit seal to fix provisionally the rear panel to the front panel; detaching the flat plate from the both panels; applying frit seal to the pin electrodes; and burning the whole of components. In this way, both of the panels are fixed provisionally on condition that the panels are kept uniformly in contact with one another using the flat plate. In this way, it is possible to prevent a gap formed between both of the panels due to their warping and to prevent the frit seal from spreading into the gap between both of the panels. Moreover, it is unnecessary to vary conditions for burning the frit seal. The frit seal is therefore burned on condition that the pin electrodes 6 can be coated adequately.

With the above arrangement, the method may comprise the steps of: placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and securing the flat plate to the base plate by screws. In this way, the front panel and the rear panel are sandwiched between the flat plate and the base plate to keep the both panels in contact with one another. It is therefore possible to reliably prevent the spread of the frit seal into the gap between the both panels on application of the frit seal and on burning.

With the above arrangement, the method may comprise the steps of: placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and securing the flat plate to the base plate by screws through a plurality of biasing means. In this way, the front panel and the rear panel are sandwiched between the flat plate and the base plate to keep the both panels in contact with one another. It is therefore possible to reliably prevent the spread of the frit seal into the gap between the both panels on application of the frit seal and on burning.

With the above arrangement, the frit seal, which is applied to the

end of the front panel and the side face of the rear panel, may have flowability less than the frit seal applied to the pin electrodes. In this way, it is possible to reduce the amount of the frit seal, which spreads from the margins of the both panels into the gap, to the minimum level.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross sectional view of a side-seal structure of the flat, light-emitting display panel disclosed in the previous application.

FIG. 2 is a cross sectional view of a state of warping occurred in the front and rear panels.

FIG. 3 is a cross sectional view for explaining a method of correcting the warping occurred in the front and rear panels, shown in FIG. 2.

FIG. 4 is a plan view for explaining the first half of process in a method for fabricating a flat, light-emitting display panel as embodiment 1 according to the invention.

FIG. 5 is a cross sectional view taken along lines V-V of FIG. 4.

FIG. 6 is a plan view for explaining the second half of process in the method for fabricating a flat, light-emitting display panel as embodiment 1 according to the invention.

FIG. 7 is a cross sectional view taken along lines VII-VII of FIG. 6.

FIG. 8 is an enlarged cross sectional view for explaining a process of application of the frit seal to the pin electrode in the method for fabricating a flat, light-emitting display panel as embodiment 1 according to the invention.

FIG. 9 is a plan view for explaining a process in the method for fabricating a flat, light-emitting display panel as embodiment 2 according to the invention.

FIG. 10 is a cross sectional view taken along lines X-X of FIG. 9.

FIG. 11 is an enlarged cross sectional view for explaining a process in the method for fabricating a flat, light-emitting display panel as embodiment 3 according to the invention.

BEST MODES FOR CARRYING OUT THE INVENTION

To explain the invention more in detail, the best modes of carrying out the invention will be described with reference to the accompanying drawings.

Embodiment 1

FIG. 4 is a plan view for explaining the first half of process in a method for fabricating a flat, light-emitting display panel as embodiment 1 according to the invention. FIG. 5 is a cross sectional view taken along lines V-V of FIG. 4. FIG. 6 is a plan view for explaining the second half of process in the method for fabricating a flat, light-emitting display panel as embodiment 1 according to the invention. FIG. 7 is a cross sectional view taken along lines VII-VII of FIG. 6. FIG. 8 is an enlarged cross sectional view for explaining a process of application of the frit seal to the pin electrode in the method for fabricating a flat, light-emitting display panel as embodiment 1 according to the invention. Moreover, components of the embodiment 1, which are common to the components shown in FIG. 1 to FIG. 3 disclosed in the previous application, are denoted by the same reference numerals and further description will be omitted.

In the drawing, a reference numeral 6 denotes a plurality of pin electrodes mounted on electrodes of the front panel 1. A reference numeral 7 denotes a slit-shaped through hole formed at the rear panel 2 and allowing the penetration of the pin electrodes 6. A reference numeral 8 denotes a locating purpose base plate (base plate) for setting a relative location between the front panel 1 and the rear panel 2. A reference numeral 9 denotes screw holes formed in the four corners of the base plate 8. A reference numeral 10 denotes a location purpose pin projected from a required position of the base plate 8. The location purpose pin 10 is a tier-pin. A diameter of an upper section 10a of the pin 10 is set to be larger than that of a lower section 10b of the pin 10 by one-half of difference in length between one edge of the front panel 1 and one edge of the rear panel 2. The upper section 10a comes in contact with a side section of the rear panel 2 and the lower section 10b comes in contact with a side section of the front panel 1.

Next, a method for fabricating a display panel as the embodiment 1 will be explained in order of undergoing process.

First, the stacked panels 1 and 2 are placed on the base plate 8. At this time, the pin electrode 6 of the front panel 1 is passed through the slit-shaped through hole 7 of the rear panel 2 as shown in FIG. 4 and FIG. 5. The side of the front panel 1 is pressed against the lower section 10b of the location purpose pin 10 due to a force indicated by arrow F1. At the same time, the side of the rear panel 2 is pressed against the upper section 10a of the location purpose pin 10 due to a force indicated by arrow F2. In this way, both of the front panel 1 and the rear panel 2 are centered.

The force indicated by F1 and F2 may be produced by a manual operation, or by using a biasing force of spring and so on, or by using a tightening force of screws, or by using a pneumatic pressure.

5 Next, the rear panel 2 is pressed down by using a press plate (flat plate) 11 as shown in FIG. 6 and FIG. 7. Here, since the press plate 11 is provided with a slit-shaped hole 12 formed at a position corresponding to the pin electrode 6 as in the case of the slit-shaped through hole 7 of the rear panel 2, the pin electrode 6 is passed through the slit-shaped
10 hole 12. Next, the press plate 11 fixes provisionally the base plate 8 using a screw 13 screwed in the screw hole 9. At this time, since the front panel 1 and the rear panel 2 are pressed across the whole of the panels, the panels 1 and 2 can be kept uniformly in contact with one another. The screws 9 are fixed at the screw holes 9 which are formed at least at four
15 corners of the base plate 8. Alternatively, as shown in FIG. 6, the screws 9 may be fixed at eight positions, for example, formed along the peripheries of the press plate 11, if necessary.

20 Next, both of the panels 1 and 2 are pressed across the whole of the panels due to the fix of the press plate 11 and the base plate 8. In such a condition, the frit seal 4 is applied to a base section of the pin electrode 6 within the slit-shaped through hole 7 of the rear panel 2 using a dispenser 14 as shown in FIG. 8. The pin electrode 6 is coated with the
25 frit seal 4 through the slit-shaped through hole 7. Moreover, the press plate 11 must have a thickness to a certain extent in order to prevent it from deforming. When the press plate 11 is too thick, it is difficult to apply the frit seal 4 to the pin electrode 6. It is preferable that the press plate 11 is approximately 2mm to 3mm thick, and the invention is limited to this range. In order to facilitate the application of the frit seal
30 4, a tapered section 12a is formed at a peripheral section of the slit-shaped hole 12 formed at the press plate 11 as shown in FIG. 8.

35 Next, the frit seal 4 is dried, and then the both panels 1 and 2 are removed from a jig including the base plate 8 and the press plate 11. In such a condition, the pin electrode is fixed provisionally using the
40 dried frit seal 4. The both panels 1 and 2 intend to deform due to a warping force of the panels exerted on the pin electrode 6 fixed provisionally as a fulcrum. However, both of the panels 1 and 2 are hardly deformed and plane in parallel with the base plate 8 because the pin electrodes 6 are arranged in close to the ends of the panels.

In such a condition, the frit seal 4 is applied to the side faces of the respective panels 1 and 2 using the dispenser 14. At this time, since both of the panels 1 and 2 are preferably fixed in a state of the both being plane, a gap between ends of the panels is reduced to a slight of 0.04mm or less. Therefore, the amount of spread of the frit seal 4 into the gap becomes very little.

Next, the pipe-shaped, tipped section is fixed using the frit seal 4. The frit seal 4 is then burned on condition that the weights (not shown) are placed on both of the panels 1 and 2 to seal the margin of the both panels 1 and 2. Each of the weights has a hole through which the pin electrode 6 and the pipe-shaped, tipped section (not shown) are passed. The hole prevents the weights from pressing both of the panels 1 and 2 and allows a part other than the pin electrode 6 and so on to be pressed uniformly. Unless the pressure is exerted uniformly on both of the panels 1 and 2, the frit seal 4 softened on burning is spread into the cell.

As described above, according to the embodiment 1, both of the panels 1 and 2 are fixed provisionally on condition that the panels 1 and 2 are kept uniformly in contact with one another using the press plate 11. In this way, it is possible to prevent a gap formed between both of the panels 1 and 2 due to their warping and to prevent the frit seal 4 from spreading into the gap between both of the panels 1 and 2.

As described above, with the embodiment 1, it is unnecessary to vary conditions for burning the frit seal. The frit seal is therefore burned on condition that the pin electrodes 6 can be coated adequately.

Embodiment 2

FIG. 9 is a plan view for explaining a process in the method for fabricating a flat, light-emitting display panel as embodiment 2 according to the invention. FIG. 10 is a cross sectional view taken along lines X-X of FIG. 9. Components of the embodiment 2 common to the components of the embodiment 1 are denoted by the same reference numerals and further description will be omitted.

The embodiment 2 is characterized in that a plural of coil springs (biasing means) 15 are disposed between the rear panel 2 and the press plate 11 at appropriate intervals. Each of the coil springs 15 works in a direction

of increasing a distance between the rear panel 2 and the press plate 11. Since the distance is increased due to a biasing force of the coil spring 15, the front panel 1 and the rear panel 2 can be kept uniformly in contact with one another due to a stress of the press plate 11 exerted on the rear panel 2.

Moreover, with the embodiment 2, recesses allowing a part of the coil spring 15 defined as the biasing means to be inserted are formed in the lower face of the press plate 11. The biasing means is not limited to forms of the coil spring 15. Elastic body such as leaf springs, air springs, or rubber bush is available, and is used as appropriate in consideration of required contact characteristics or cost.

Embodiment 3

With the embodiment 1 or 2, the frit seal is applied to the pin electrode 6 and then the side of the panel. With the embodiment 3, the application of the frit seal is performed in inverse order. That is, with the embodiment 3, the frit seal is applied to the side of the panel on condition that the whole of the panels 1 and 2 is pressed uniformly, and is dried to fix provisionally the both panels 1 and 2. The frit seal is then applied to the pin electrode 6 and is burned.

According to the embodiment 3, the front panel 1 and the rear panel 2 are fixed provisionally on condition that the whole of the panels 1 and 2 is pressed uniformly as in the case of the embodiment 1 or 2. In this way, it is possible to prevent a gap formed between both of the panels 1 and 2 due to their warping and to prevent the frit seal 4 from spreading into the gap between both of the panels 1 and 2.

Moreover, with the embodiment 3, the press plate 8 is used in pressing uniformly the whole of the panels 1 and 2, as in the case of the embodiment 1 or 2. Alternatively, a weight 16 may be used in pressing uniformly them. That is, a recess 16a, which avoids coming in contact with the pin electrode 6, is formed in a lower face of the weight 16. The weight 16 is placed on the rear panel 2 stacked on the front panel 1. In such a state, the frit seal is applied to the side of the both panels 1 and 2. In this way, since the weight 16 is heavier than the press plate 11 in the embodiment 1 or 2, it is possible to reduce the gap between the both panels 1 and 2 to the limit and to prevent spread of the frit seal 4 with reliability. With the embodiment 3 of using the weight 16, since the press plate 11 has

no use for pressing the panels, it is possible to reduce a component count and to simplify a fabricating process.

Moreover, the weight 16 pressing uniformly the both panels 1 and 2 may be preferably replaced by, for example, spring members, compressed air and so on.

Embodiment 4

The embodiment 4 is characterized in that a frit seal, which is applied to the side of the panels, has flowability less than a frit seal applied to the pin electrodes 6. In this way, it is possible to coat the electrode with the frit seal and to reduce the spread of the frit seal into the side of the panels.

The frit seal is a mixture of mixing PbO-B2O3 system glass powder, for example, with filler such ceramic powder. Factors such as the quality of the filler, a mixing ratio, a particle diameter and so on are changed, and it is therefore possible to control the flowability of the frit seal. Examples of the combination of various kinds of frit each having different flowability includes LS-0118 and LS-0206 prepared by Japanese Electronics and Glass Co. Ltd., for example. The temperature condition in sealing such as 430 degrees centigrade for ten minutes or 450 degrees centigrade for fifteen minutes is recommended. That is, when two kinds of the frit seal is burned on the same temperature and the same period, the LS-0206 has flowability less than the LS-0118. Therefore, the LS-0118 having high flowability relative to the other is used to be applied to the pin electrode 6, and the LS-0206 having low flowability relative to the other is used to be applied to the side of the panels. The frit seal is burned at the temperature of 445 degrees centigrade for fifteen minutes. In this way, it is possible to coat perfectly the pin electrode 6 with the frit seal having high flowability, and to prevent entirely the spread of the frit seal having low flowability into the side of the panels. Moreover, the frit seal of LS-0118 is replaced by DT-430 prepared by Iwaki glass Co. Ltd., having the property as in the case of the two kinds of frit seal above.

As described above, according to the embodiment 4, since the various kinds of the frit seal are used depending on places to which they are applied, it is possible to improve image quality on request to the display panel.

INDUSTRIAL APPLICABILITY

CLAIMS:

1. A method for fabricating a flat, light-emitting display panel including a transparent, front panel, a rear panel arranged in parallel to the front panel and having a plurality of recesses, each recess being defined as a discharging space for a display cell, a pin electrode projected inwardly in a state of penetrating the rear panel, and a pair of cell-type electrodes, which works at the presence of voltage from the pin electrodes, arranged at every area of the front panel facing each of the recesses of the rear panel,

wherein the method comprises the steps of:

applying frit seal to the pin electrodes in a state of pressing the rear panel against the front panel to keep them in contact with one another using a flat plate having an opening formed at a position corresponding to each of the pin electrodes;

drying the frit seal to fix provisionally the rear panel to the front panel;

detaching the flat plate from the both panels;

applying frit seal to an end of the front panel and a side face of the rear panel; and

burning the whole of components.

2. A method for fabricating a flat, light-emitting display panel according to Claim 1, comprising the steps of:

placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and

securing the flat plate to the base plate by screws.

3. A method for fabricating a flat, light-emitting display panel according to Claim 1, comprising the steps of:

placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and

securing the flat plate to the base plate by screws through a plurality of biasing means.

4. A method for fabricating a flat, light-emitting display panel according to Claim 1, wherein the frit seal, which is applied to the end of the front panel and the side face of the rear panel, has flowability less than the frit seal applied to the pin electrodes.

5. A method for fabricating a flat, light-emitting display panel including a transparent, front panel, a rear panel arranged in parallel to the front panel and having a plurality of recesses, each recess being defined as a discharging space for a display cell, a pin electrode projected inwardly in a state of penetrating the rear panel, and a pair of cell-type electrodes, which works at the presence of voltage from the pin electrodes, arranged at every area of the front panel facing each of the recesses of the rear panel,

wherein the method comprises the steps of:

applying frit seal to an end of the front panel and a side face of the rear panel in a state of pressing the rear panel against the front panel to keep them in contact with one another using a flat plate having an opening formed at a position corresponding to each of the pin electrodes;

drying the frit seal to fix provisionally the rear panel to the front panel;

detaching the flat plate from the both panels;

applying frit seal to the pin electrodes; and

burning the whole of components.

6. A method for fabricating a flat, light-emitting display panel according to Claim 5, comprising the steps of:

placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and

securing the flat plate to the base plate by screws.

7. A method for fabricating a flat, light-emitting display panel according to Claim 5, comprising the steps of:

placing both of the front panel and the rear panel stacked to the front panel on a base plate having a flat face; and

securing the flat plate to the base plate by screws through a plurality of biasing means.

8. A method for fabricating a flat, light-emitting display panel according to Claim 5, wherein the frit seal, which is applied to the end of the front panel and the side face of the rear panel, has flowability less than the frit seal applied to the pin electrodes.

ABSTRACT

A method for fabricating a flat, light-emitting display panel includes the steps of applying frit seal to the pin electrodes in a state of pressing the rear panel against the front panel to keep them in contact with one another using a flat plate having an opening formed at a position corresponding to each of the pin electrodes; drying the frit seal to fix provisionally the rear panel to the front panel; detaching the flat plate from the both panels; applying frit seal to an end of the front panel and a side face of the rear panel; and burning the whole of components. The sequence of the application of the frit seal to the pin electrode and the application of the frit seal to the end of the front panel and the side face of the rear panel may be altered. The frit seal having flowability less than the frit seal applied to the pin electrode is applied to the end of the front panel and the side face of the rear panel.

FIG.1

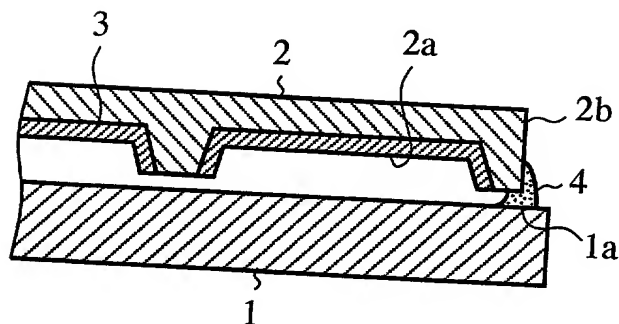


FIG.2

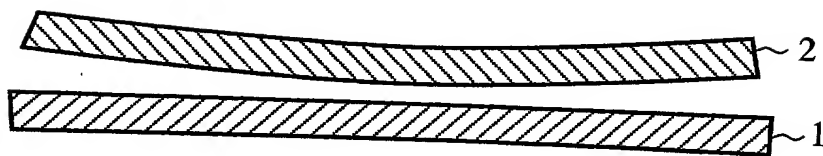


FIG.3

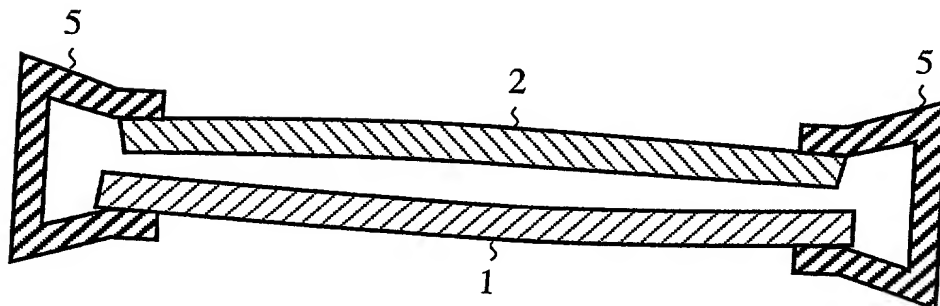


FIG. 4

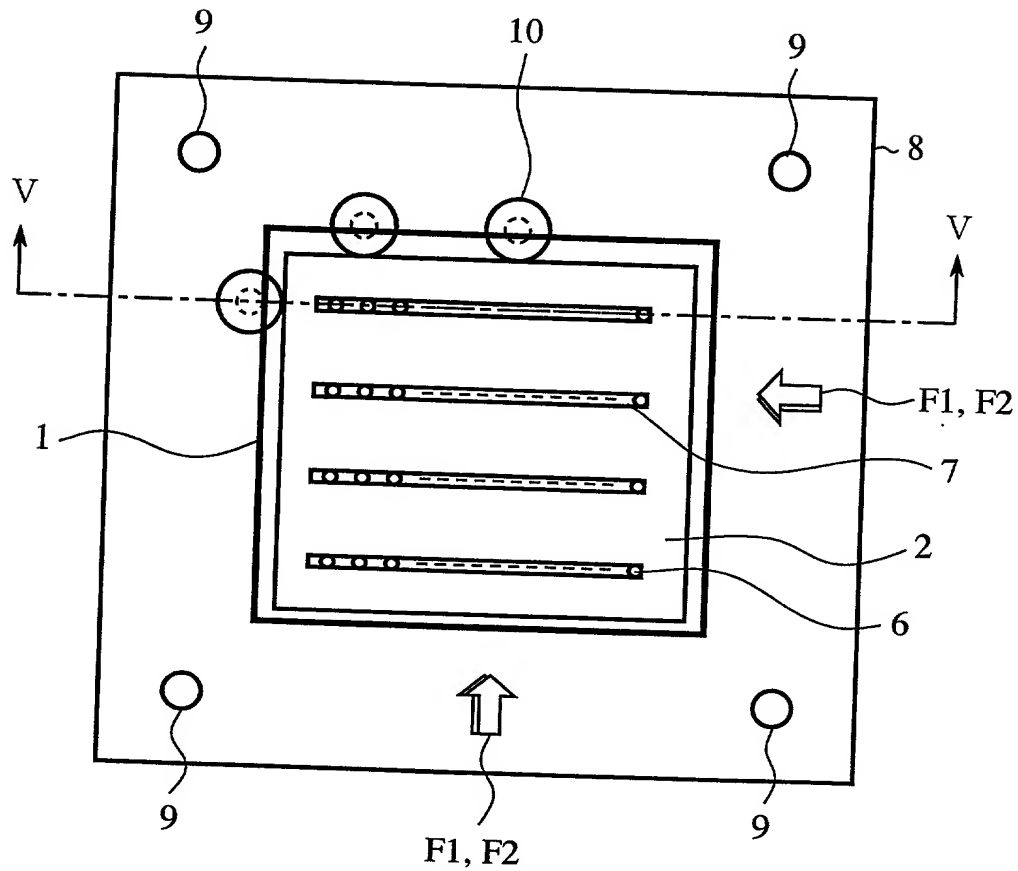
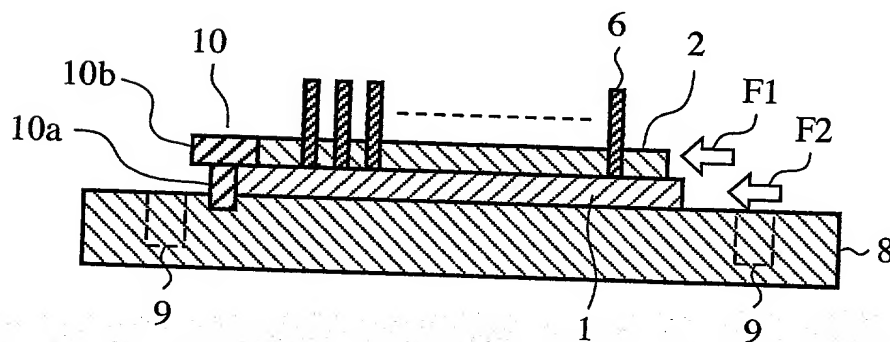


FIG. 5



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FIG.6

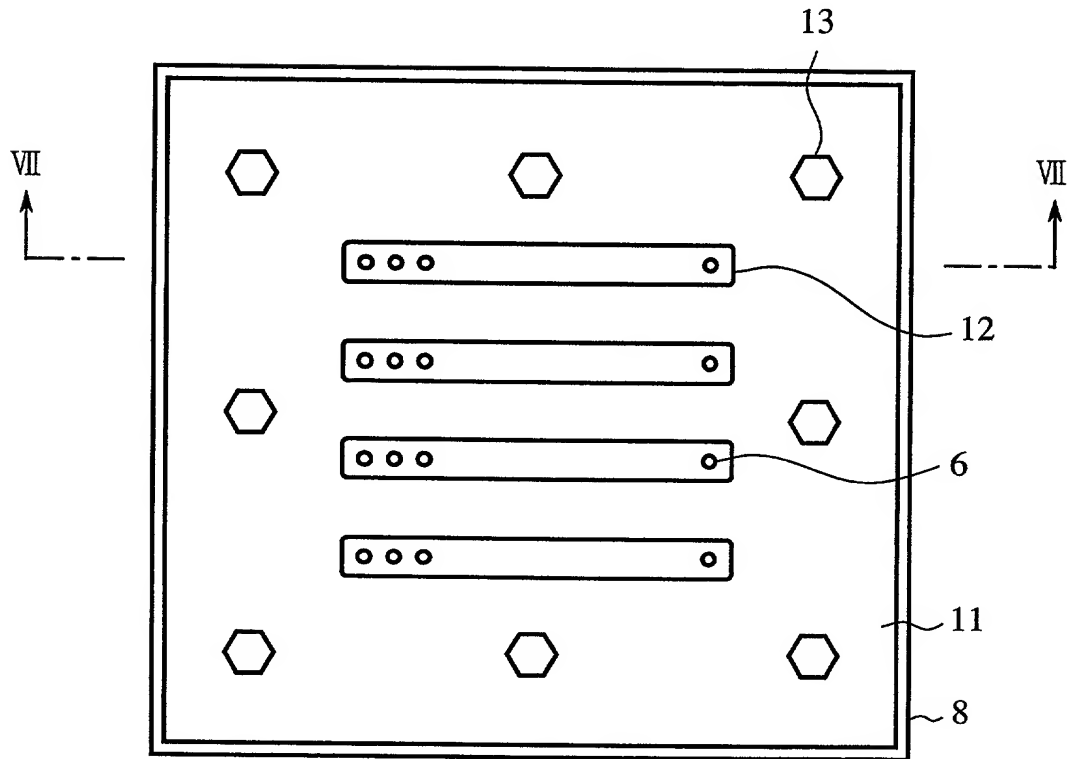


FIG.7

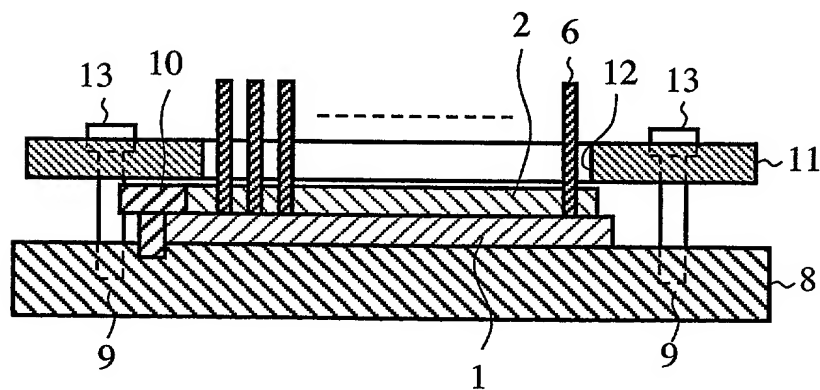


FIG.8

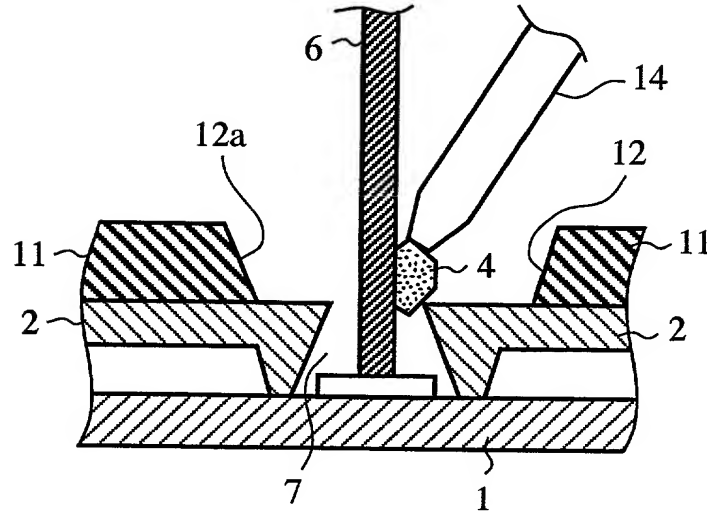


FIG.9

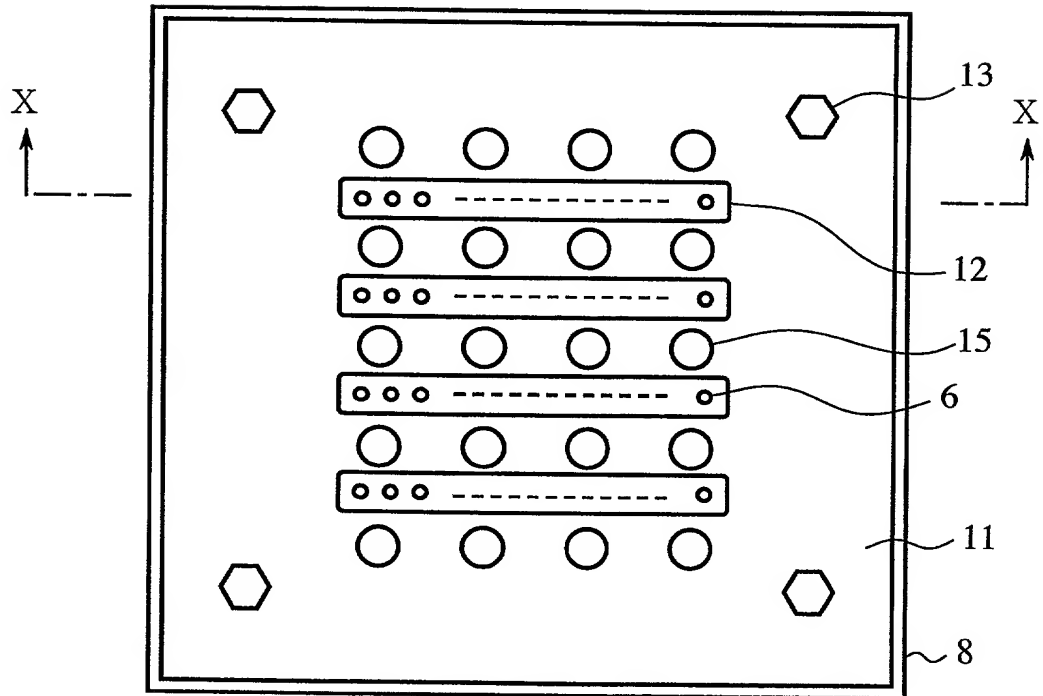


FIG.10

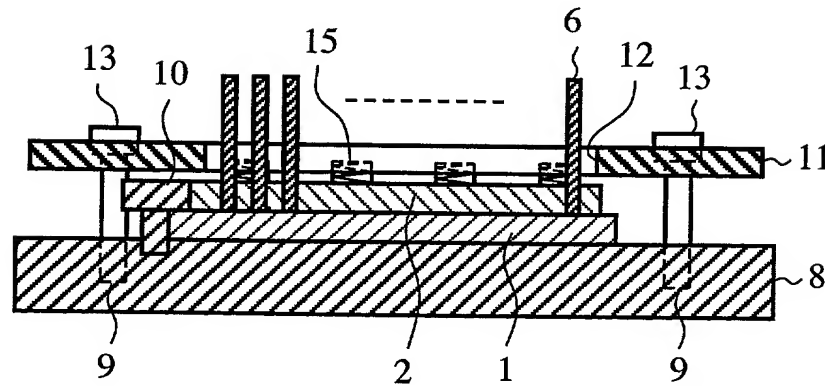
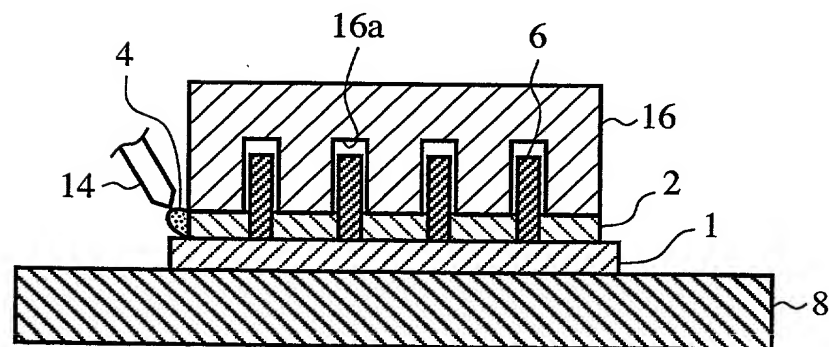


FIG.11



Declaration and Power of Attorney For Patent Application

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者（下記の名称が複数の場合）であると信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

"METHOD FOR FABRICATING A FLAT, LIGHT-
EMITTING DISPLAY PANEL"

上記発明の明細書は、

本書に添付されています。

____月____日に提出され、米国出願番号または特許協定条約国際出願番号を____とし、
(該当する場合) _____に訂正されました。

the specification of which

☐ is attached hereto.

☒ was filed on August 7, 2000

as United States Application Number or

PCT International Application Number

PCT/JP00/05289 and was amended on

____ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

Japanese Language Declaration
(日本語宣言書)

私は、米国法典第35編119条 (a) - (d) 項又は365条 (b) 項に基づき下記の、米国以外の国の少なくとも一カ国を指定している特許協力条約365 (a) 項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

Prior Foreign Application(s)
外国での先行出願

(Number)
(番号)

(Country)
(国名)

(Number)
(番号)

(Country)
(国名)

私は、第35編米国法典119条 (e) 項に基づいて下記の米国特許出願規定に記載された権利をここに主張いたします。

(Application No.)
(出願番号)

(Filing Date)
(出願日)

私は、下記の米国法典第35編120条に基づいて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約365条 (c) に基づく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第35編112条第1項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第37編1条56項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

(Application No.)
(出願番号)

(Filing Date)
(出願日)

(Application No.)
(出願番号)

(Filing Date)
(出願日)

私は、私自信の知識に基づいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じることに基づく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編第1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行えば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Priority Claimed
優先権主張

☐ Yes
はい

☐ No
いいえ

☐ Yes
はい

☐ No
いいえ

(Day/Month/Year Filed)
(出願年月日)

(Day/Month/Year Filed)
(出願年月日)

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.)
(出願番号)

(Filing Date)
(出願日)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.

(Status: Patented, Pending, Abandoned)
(現況: 特許許可済、係属中、放棄済)

(Status: Patented, Pending, Abandoned)
(現況: 特許許可済、係属中、放棄済)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration
(日本語宣言書)

委任状：私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。
(弁理士、または代理人の指名及び登録番号を明記のこと)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)



022850

書類送付先

Send Correspondence to:



022850

直接電話連絡先：(名前及び電話番号)

Direct Telephone Calls to: (name and telephone number)
(703) 413-3000

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(Supply similar information and signature for third and subsequent joint inventors.)

Japanese Language Declaration
(日本語宣言書)

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国籍		Citizenship <u>Japanese</u>
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郵便の宛先		Post Office Address

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住所		Residence
国籍		Citizenship
郵便の宛先		Post Office Address

第六の共同発明者の氏名		Full name of sixth joint inventor, if any
第六の共同発明者の署名	日付	Sixth joint Inventor's signature Date
住所		Residence
国籍		Citizenship
郵便の宛先		Post Office Address

(第六またはそれ以降の共同発明者に対しても同様な情報および署名を提供すること。)

(Supply similar information and signature for third and subsequent joint inventors.)